COMMERCIAL FIELD EVALUATIONS OF METHYL BROMIDE ALTERNATIVES IN FLORIDA STRAWBERRY

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The studies reported herein are part of a continuing effort to identify and evaluate alternatives to methyl bromide for sting nematode, *Belonolaimus longicaudatus*, management in Florida strawberry. During the 2004 - 2005 strawberry production season, twelve grower field demonstration trials were conducted in Plant City, FL to evaluate various chemical and nonchemical alternatives to minimize or totally exclude use of methyl bromide soil fumigation.

Emission Reduction / VIF trials: These trials included four emissions reduction studies evaluating replicated plots of virtually impermeable mulch film (VIF) to reduce methyl bromide field application rates by 50 to 75% and to compare crop growth and pest control efficacy with treatments utilizing standard low density polyethylene (LDPE) film. In general, nutsedge control (*Cyperus esculentus* and *C. rotundus*) was the primary interest at the Grooms farm trial evaluating VIF and 50 and 75% use rate reductions, chloropicrin (336 kg ha^{-1}) plus Goal (2 qt/a), a new 50 / 50 formulation of methyl bromide chloropicrin (358 kg ha^{-1}). The results from the Grooms trial with VIF demonstrated it was possible to reduce the methyl bromide application rate from 448 to 224 kg· per treated ha^{-1} without significant (P#0.01) loss in nutsedge control obtained with methyl bromide applied at 448 kg·per treated ha^{-1} under LDPE (Fig 2). However, nutsedge control and plant size (crown diameter) were significantly (P#0.01) reduced with the 75% reduced rate VIF treatment (112 kg ha^{-1}) compared to that of methyl bromide applied at 448 kg·per treated ha^{-1} under LDPE (Figure 1,2). At none of the VIF field demonstration sites were substantial differences in the incidence of dead or decline plants per 15 m row ever observed between half rates of methyl bromide chloropicrin and VIF, compared to standard use full rates with LDPE. At the Floral City field demonstration site, VIF treatments with 98 and 196 kg per treated ha^{-1} methyl bromide chloropicrin rate reductions both provided effective nutsedge control and increased plant size (crown diameter) to levels equivalent with that of standard LPDE mulch and a maximum, overall methyl bromide chloropicrin (67/33)fumigation rate of 392 kg per ha^{-1} (Table 1).

Host Plant Resistance: Tolerance in strawberry to the sting nematode has not been identified in previous research. As a continuation of the search for nematode tolerance in strawberry, four nematode infected fields were selected to evaluate six commercially available strawberry cultivars for tolerance to sting nematode (Table 2). Tolerance is defined as the ability to suffer less or to maintain crop yield in the presence of the nematode as it does in the absence of the nematode. In

each grower field, the six strawberry cultivars were planted in areas annually problematic with the sting nematode, and in another proximate area where nematodes have historically not been a problem. Identical cultural and production practice were maintained between blocks. In each block, six cultivars, including the grower planted standard, were planted into a randomize block design and replicated five times. In these four trials, differences in plant growth, including comparisons of plant size, vigor, consistency, plant mortality, and nematode and disease incidence and severity were evaluated on a periodic basis during the growing season. A relative tolerance rating was computed by dividing the performance value of a given variety within the non problem area by the performance value of the same variety grown within the nematode problem area. Overall, it would appear that little tolerance to sting nematode occurs, and of those cultivars tested, Ventana and Camerosa proved to be the least tolerant and the cultivars Carmine and Candonga to be the most tolerant (Table 2).

Alternative Chemical Trials: Two grower field studies focused on a co-application approach of different fumigants, herbicides, and other alternative tactics to achieve pest control efficacy and crop growth response similar to that of methyl bromide. Among the sites, treatments included broadcast equivalent methyl bromide chloropicrin 98/2 (448 kg ha^{-1}), methyl bromide chloropicrin 67/33 (392 kg ha^{-1}), methyl bromide chloropicrin 50/50 (358 kg ha^{-1}), chloropicrin (336 kg ha^{-1}) plus Goal herbicide (1.9 l ha^{-1}), and Telone C35 (98 l ha^{-1}). Assessments of plant growth were made as appropriate during the course of the season to characterize differences in plant size, health, and vigor. Following chemical treatment, weed densities (i.e., nutsedge germination within 15 m of row) were monitored and recorded on a periodic basis to determine differences in weed control. An untreated control was not included for comparison in any trial. All treatments were arranged within their respective experimental areas as a completely randomized block design with 3 or 4 replications per treatment. Based on the overall results of the Sewell farm demonstration trial, strawberry plant growth and vigor with in-row treatments of Telone C35 (98 l ha^{-1}) were observed to be equivalent to that of methyl bromide. No significant (P#0.05) differences in numbers of dead, decline, or weed densities among treatments were observed season long. In this trial, grower observed differences in yield were not reported. While at Grooms farm, weed control of yellow and purple nutsedge was significantly (P#0.05) reduced with soil fumigation treatments of chloropicrin alone plus Goal herbicide, with a 50/50 formulation of methyl bromide chloropicrin (358 kg ha^{-1}), and with the 75% reduced rate VIF treatment (Fig. 2).

GENERAL SUMMARY:

- A loss of fumigant synergy with chloropicrin when methyl bromide use rates are reduced below critical levels within a formulation.
- Limits to the extent to which methyl bromide use rates can be reduced without loss or pesticidal efficacy and crop growth performance.
- In general, few differences in plant tolerance to sting nematode was

observed between six strawberry cultivars evaluated at four grower field sites.

Table 1. Results of Floral City Fl grower field trial evaluating replicated plots of virtually impermeable mulch film (VIF) to reduce methyl bromide field

TREATMENT	% of Maximum Grower Rate (392 kg ha)	Nutsedge 15 m row	Plant Size (in^2)
VIF (Bromostop)	100%	0.0 b	232.0 a
VIF (Bromostop)	25%	0.0 b	210.5 a
VIF (Klerk)	100%	0.0 b	217.5 a
VIF (Klerk)	50%	0.0 b	209.3 a
VIF (Klerk)	25%	0.2 b	197.7 a
VIF (Klerk)	0%	**38.1 a**	**115.3 b**
LDPE	100%	0.1 b	219.4 a
LDPE	0%	**29.8 a**	**102.2 b**

application rates by 50 to 75% and to compare crop growth and pest control efficacy with treatments utilizing standard low density polyethylene (LDPE) film.

Table 2. Results of four Plant City FL grower trials evaluating tolerance of six strawberry cultivars to the Sting nematode, *Belonolaimus longicaudatus*. Tolerance defined as the ability to produce well even in the presence of the nematode

Strawberry Cultivar	Site 1 MBF	Site 2 BDF	Site 3 JDF	Site 4 RCF	AVG
Camino Real	79.7	79.3	78.9	87.2	81.3
Carmine	98.4	85.1	78.8	--	87.4
Camarosa	--	63.9	97.7	59.7	73.8
Candonga	--	100.1	69.1	91.7	87.0
Festival	96.4	73.4	66.2	91.9	82.0
Treasure	79.7	--	--	79.4	79.6
Ventana	54.8	66.3	76.2	--	65.8
Grower Standard	118.5	96.6	81.8	88.2	96.2

Figure 1. Strawberry crop growth response to treatments included 1) broadcast equivalent methyl bromide chloropicrin 98/2 (448 kg ha^{-1}), methyl bromide chloropicrin 98/2 (224 kg ha^{-1}) + VIF; 3) methyl bromide chloropicrin 98/2 (112 kg ha^{-1}) + VIF; 4) methyl bromide chloropicrin 50/50 (358 kg ha^{-1}), and chloropicrin alone (336 kg ha^{-1}) plus Goal herbicide (1.9 l ha^{-1}).

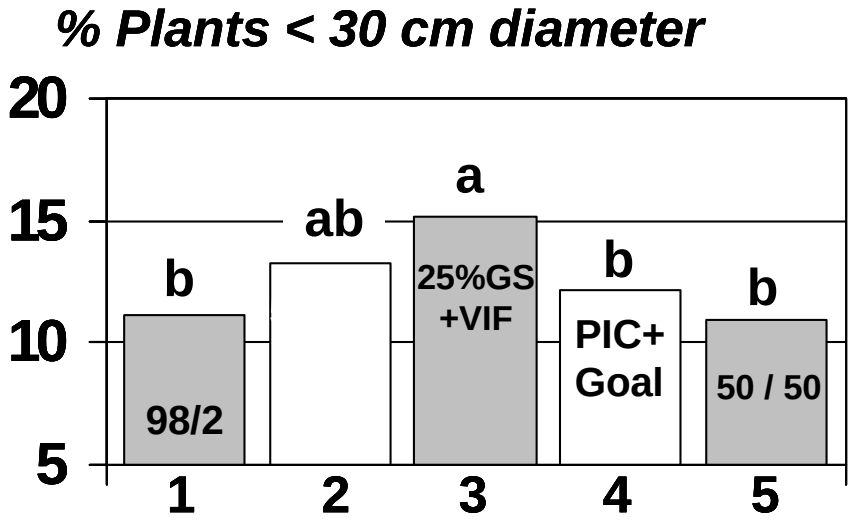

Figure 2. Percent of treated rows expressing density nutsedge growth within soil fumigant treatments of 1) broadcast equivalent methyl bromide chloropicrin 98/2 (448 kg ha^{-1})+LDPE, methyl bromide chloropicrin 98/2 (224 kg ha^{-1}) + VIF; 3) methyl bromide chloropicrin 98/2 (112 kg ha^{-1}) + VIF; 4) methyl bromide chloropicrin 50/50 (358 kg ha^{-1}), and chloropicrin alone (336 kg ha^{-1}) plus Goal herbicide (1.9 l ha^{-1}).